a specificity of 80%. Moreover, IVA was found to be the least load-dependent while basal 2D-Strain and RMPI appeared to be afterload and preload dependent.

Conclusions.— In patients with a suspicion of RV dysfunction, S' and RVFAC are frequently discordant (58% of the patients). Using a group of highly probable RV dysfunction (S' < 10 cm/s AND RVFAC < 35%), we found that IVA and basal 2D-Strain have both a good diagnostic value. Moreover, contrary to 2D-strain, IVA was not influenced by loading conditions, adding to its diagnostic value. Our results underline the need of a multiparametric approach to diagnose RV dysfunction and for this setting both IVA and 2D strain could help.

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Transthoracic and transesophageal echocardiography during acute respiratory distress syndrome: Prevalence of acute cor pulmonale and patent foramen ovale. Arcofop multicentre study

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Background.— Acute increase in right ventricular overload secondary to acute respiratory distress syndrome (ARDS) may result in acute cor pulmonale (ACP). Hypoxemia could be worsened by the increased right-to-left shunting across a patent foramen ovale (PFO).

Objectives.— To assess prevalence of ACP and PFO in ventilated patients with ARDS during the first 48 hours. We secondary aimed to assess transthoracic echocardiography (TTE) feasibility and main measurements compared to transesophageal echocardiography (TEE).

Patients.— This prospective observational study in nine intensive care units enrolled all patients with ARDS (new bilateral pulmonary infiltrates on chest X-ray, PaO2/FiO2 ratio $\leq$ 200 and no left ventricular pressure overload). TTE and TEE were performed by trained intensivists, digitally recorded and reviewed by two experts. ACP was diagnosed when right ventricle was dilated (end-diastolic right ventricle/left ventricle area (RV/LV) ratio > 0.6 in the four-chamber views) associated with septal dyskinesia [eccentricity index > 1 on the short-axis view (TTE) and the transgastric short axis view (TEE)]. PFO was detected by contrast study on the apical four-chamber view (TTE) and 0° and bicaval views (TTE).

Results.— During 34 months 204 patients were studied. Two hundred patients were analysable. Mean ± SD were: age 56 ± 15 year-old, SAPS II 46 ± 17, PaO2/FiO2 115 ± 39, PEEP 11 ± 3 cm H2O. Day 28 mortality rate was 23% (CI 95% [17—29]). ACP was diagnosed in 45 patients (22.5%; CI 95%[16.9—28.9]) and PFO in 31 (15.5%; CI 95%[10.8—21.3]). Right-to-left interatrial shunting was small in 27 patients, moderate in 4 patients and intermittent in 26 patients. ACP and PFO were associated in nine patients (4.5%; CI 95% [2.1—8.4]). TTE compared to TEE measurements had sensitivity and specificity respectively of 42.1% and 97.7% (PFO) and 30.6% and 90.1% (ACP). RV/LV ratio measurement was 0.7 ± 0.2 (mean ± SD) and systolic eccentricity index was 1.11 ± 0.14 (mean ± SD). TTE allowed measurement of other right ventricular function parameters: tricuspid regurgitation velocity (277 ± 56 cm/s), tissue Doppler-derived tricuspid lateral annular systolic velocity (15.8 ± 6.5 cm/s) and tricuspid annular plane systolic excursion (19.7 ± 5.2 mm) (TAPSE). TEE allowed measurement of right ventricular fractional area change (33 ± 13%). Mean values (Student test) were significantly different for RV/LV ratio (P = 0.03) and eccentricity index (P = 0.03) between patients with PFO compared to patients without PFO and for right ventricular fractional area change (P = 0.0002) and TAPSE (P = 0.05) between patients with ACP compared to patients without ACP.

Conclusion.— These results in patients with early severe ARDS under protective mechanical ventilation found prevalence of 22.5% of ACP and 15.5% of PFO. Low TTE sensitivity requires TEE for diagnosis of PFO and ACP. PFO was associated with significantly increase of RV/LV ratio and eccentricity index. ACP was associated with significantly decrease of right ventricular fractional area change and TAPSE.

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Comparative echocardiographic evaluation of right ventricular function in Eisenmenger syndrome and idiopathic pulmonary arterial hypertension

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Background.— Despite comparable morbidity, survival prospects for Eisenmenger pts are far superior compared with pts with idiopathic pulmonary arterial hypertension (PAH). This improved survival is likely the result of the preservation of RV function, since it does not remodel at birth and remains hypertrophied and adapted to pressure overload.

Aim of study.— We compared the echocardiographic parameters of right heart function between pts with Eisenmenger syndrome and pts treated for idiopathic PAH, with an equal level of systolic PAP (PAPs).

Patients.— We studied 15 pts with Eisenmenger (group 1: three CAVC, six ASD, two VSD, two ductus arteriosus, one TOF, one agenesis of pulmonary artery) and 15 pts with PAH (gr2). All subjects underwent a right heart catheterization and echocardiography within the same week. Each gr2 pt was matched to a gr1 pt according to age, sex and level of PAPs (± 5 mmHg). The following indices of RV function were obtained: TAPSE (mm), RV fractional area change (RVFAC, %), myocardial performance index (Tei) and maximal velocity of systolic wave (S max, cm/s) of the lateral tricuspid annulus. We measured maximal longitudinal strain (ε, %) in the three segments of the 3 RV walls (septal (sep), lateral (lat) from 4Cview and inferior (inf) from RV2Cview) by 2D speckle imaging. We calculated a lat ε (mean of 3 lat segments), an inf ε (mean of 3 inf segments) and an inferolat ε (mean of these two walls).

Results.— The surfaces of the RA and RV were not significantly different while the ratio RV/LV was significantly higher in the PAH group (P = 0.03). There was no difference in any of the RV function parameters between both groups although there was a non-significant trend toward lower values of strain in gr2.

Gr1, Eisenmenger Gr2, PAH P value.
Age (yrs) 50.2 ± 15.8, 54.1 ± 17.8, 0.06.
IT gd max (mmHg) 78.3 ± 25.8, 77.9 ± 23.4, 0.92.
Cardiac index (l mn/m^2) 2.9 ± 0.9, 2.5 ± 0.7, 0.29.
RV/LV 1.3 ± 0.5 1.7 ± 0.5, 0.01.
Smax (cm/s) 10.8 ± 3.5, 10.6 ± 1.8, 0.51.
TAPSE (mm) 19.0 ± 8.6, 15.9 ± 3.9, 0.43.
RV FAC (%) 0.36 ± 0.14, 0.31 ± 0.07, 0.25.
RV Tei 0.52 ± 0.22 0.53 ± 0.19, 0.86.

RV lateral strain (%) −18.0 ± 4.4, −14.7 ± 5.7, 0.08.
RV septal strain (%) −13.5 ± 6.9, −14.7 ± 3.1, 0.73.
RV inferior strain (%) −17.4 ± 4.6, −13.2 ± 5.0, 0.11.
RV inferolat strain (%) −16.3 ± 4.7, −13.9 ± 3.9, 0.13.
Conclusion.— In this population of Eisenmenger pts with severe PAH, conventional parameters of RV function are not different from those of pts with idiopathic PAH at the same level of systolic PAP. However, there is a tendency, although not significant, towards a lower alteration of RV longitudinal deformation parameters in pts with Eisenmenger, suggesting a relative preservation of RV function. The lack of significant difference between the two groups may be explained by the small sample size of this population with a significant number of pts with atrial shunt. However, the effect of sustained high level of PAP may perhaps also be almost the same on the RV after a long time of evolution whatever its etiology.

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Detection of pulmonary arteriovenous malformation by contrast echocardiography in pediatric hereditary hemorrhagic telangiectasia

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Background.— In hereditary hemorrhagic telangiectasia (HHT), assessment of pulmonary arteriovenous malformations (PAVMs) may be difficult in pediatric patients. The aim of this study was to assess the reliability of contrast echocardiography in a pediatric population presenting with HHT.
Patients.— We prospectively studied 22 pediatric patients presenting with HHT. All these patients underwent transthoracic contrast echocardiography (TTCE) and low-dose thoracic computed tomography (CT). Each TTCE examination was performed using second harmonic imaging, allowing to improve the quality of 2-dimensional imaging. The contrast protocol consisted of the injection of agitated 5% glucose solution through an upper extremity vein. We used the classification proposed by Barzilai et al.: grade 0 means no opacification of the left ventricle after the first three cardiac cycles following contrast appearance in the right atrium, grade 1 means minimal opacification; grade 2, moderate; grade 3, extensive opacification without outlining the endocardium; and grade 4, extensive opacification with clear endocardial definition. We considered CT as normal when no PAVMs or only one microscopic PAVMs was detected.
Results.— Mean age of the population was 11 ± 5 years (12 male). A PAVM was detected in 10 patients (45%) by CT. TTCE was feasible in all pediatric patients. Using TTCE, a grade 0 was found in four patients, a grade 1 in seven patients, a grade 2 in five patients, a grade 3 in six patients and no patient had a grade 4. In case of grade 0 or 1, no patient had a significant PAVMs, whereas for grade 2 and 3, all patients excepted one had PAVMs. The sensibility and specificity of TTCE for the detection of PAVMs was respectively 100% and 92%.
Conclusion.— Detection of PAVMs by TTCE is feasible in pediatric patients presenting with HHT. The reliability of TTCE is high in this specific population. Low-grade classification could presumably allow to avoid CT irradiation in pediatric patients.

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Session nº 4 — Ischemic heart disease and stress-echo

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Exercise systolic pulmonary artery pressure > 60 mmHg: A questionable threshold for clinical decision. Our experience in 509 patients

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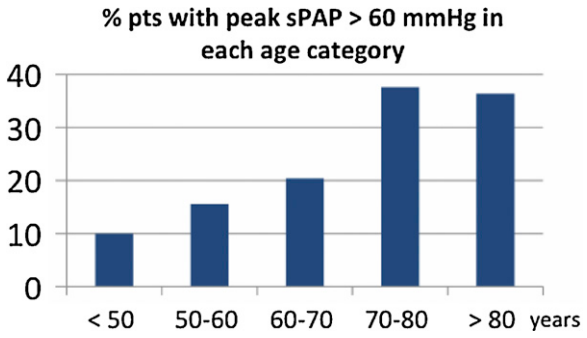
In the ACC/AHA and ESC guidelines, systolic pulmonary artery pressure (sPAP) during exercise > 60 mmHg is a criterion for surgery in asymptomatic mitral regurgitation or stenosis. Nevertheless, studies in normal volunteers have suggested that normal people > 60 years can reach this threshold. Unfortunately, only small series have been published and the usefulness of exercise sPAP in clinical practice remains subject of debate. Using Doppler exercise echocardiography, we prospectively measured sPAP at rest and during exercise in 509 patients.
Patients.— Between September 2011 and January 2013, we prospectively included all patients referred to our laboratory for exercise echocardiography with the following criteria: no significant valvular heart disease or pulmonary disease, normal rest left ventricular function and no myocardial ischemia at peak exercise. Tricuspid regurgitation velocity (Vmax) was measured using CW Doppler at rest, at 2 minutes exercise and at peak exercise. sPAP was calculated as $4 \times Vmax^2 + 5$ (mmHg). Correlations of sPAP with patients and exercise characteristics were evaluated.
Results.— Among 713 consecutive patients who fulfilled inclusion criteria, measurement of Vmax was feasible at all stages in only 509 (71.3%) patients. Mean age was 61 ± 14 years, 39% were female, 59% had treated hypertension. Mean sPAP was 29 ± 5 mmHg at rest, 37 ± 7 mmHg at low and 55 ± 11 mmHg at peak exercise. Thus, between rest and low exercise sPAP increase was low (28%) while between low and peak exercise, the increase was significantly higher (49%). sPAP at peak exercise was correlated with age ($r = 0.27$, $P < 0.0001$), with systolic arterial pressure ($r = 0.21$, $P < .0001$). At peak exercise, sPAP was significantly higher in patients treated for hypertension as compared to patients without hypertension (51 vs. 47.7 mmHg, $P < 0.0001$). Among all patients, 23% had a sPAP > 60 mmHg at peak exercise. After 70 years, 38% of patients had a peak exercise sPAP > 60 mmHg.
Conclusion.— In the present study, 23% of patients without significant cardiac disease had sPAP > 60 mmHg at peak exercise. Our data suggest that interpretation of exercise sPAP is complex and that age, systolic arterial pressure and rate of sPAP increase should be taken account for interpretation.



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